

Review of the Draft Technical Memorandum, Risk-Based Screening Level Assessment of Fixed Polonium-210 Activity Found on Bollards and Cleats at the Hunters Point Naval Shipyard, Hunters Point Shipyard, San Francisco, California, April 2018

USEPA Comments May 2, 2018

GENERAL COMMENTS

1. The Draft Technical Memorandum, Risk-Based Screening Level Assessment of Fixed Polonium-210 Found on Bollards and Cleats at the Hunter's Point Naval Shipyard (Memo) does not present a reasonable conceptual site model and assumptions regarding exposure scenario(s). The text of the Memo and Surface Preliminary Remediation Goal (SPRG) calculations include a number of assumptions in their assessment of risk due to the presence of Polonium-210 at the shipyard that are not fully supported and which do not meet the standard exposure scenarios included in EPA's 2011 Final Edition of the Exposure Factors Handbook, as indicated in the following comments.
2. **Exposure Conditions:** The first paragraph on Page 3 of 6 states that exposure via a skin abrasion or wound (i.e. injection of contaminated material) is negligible due to its potential for involving no more than a small amount of material. However, given the harsh environment of salt water and high humidity at the former Hunter's Point Naval Shipyard (HPNS) and the damp and rainy conditions in the San Francisco climate during the rainy season, it is expected that the existing metal bollards and cleats will continue to rust and degrade, resulting in surfaces that may contain sharp edges and flaking of metal/paint. As such, it appears plausible to consider exposure to a recreational receptor that includes injection of contaminated material from eroded surfaces at the shipyard. Injection should be included as an exposure pathway. Please include injection as an exposure pathway
3. **Exposure Conditions:** The Memo does not take ongoing oxidation (rusting) into account. The second paragraph on Page 3 of 6 states that a reasonable and most likely scenario for the release of the fixed Polonium-210 (Po-210) activity would be surface grinding in preparation for painting the bollard or cleat; and that an activity such as this would not occur incidentally or as a recreational activity. However, environmental conditions at the HPNS are such that metal surfaces of bollards and cleats will continue to be oxidized. This oxidation will degrade and disintegrate the surface of such objects. The disintegration of such surfaces results in the generation of particles and pieces of such metal becoming available for deposition on or around such surfaces similar to the scenario where the surface is mechanically ground. The Draft Report Final Status Survey: Ship Berths 14, 21, 22, and 29, July 2017, Appendix M, Technical Memorandum Regarding Elevated Alpha Surface Activity dated September 23, 2014 (Appendix M) states "elevated alpha activity has been found consistently on or near heavily weathered (i.e., rusted) metal surfaces." This information indicates the elevated alpha activity, attributed primarily to Po-210, is widespread throughout the shipyard area where metal objects are located; this is a different exposure scenario than presented in the Memo. Please include ongoing natural degradation and disintegration of the metal surfaces of

bollards and cleats with associated generation of particles and pieces of metal as an exposure condition.

4. **Exposure Events:** A single exposure event is not a likely scenario. The Memo states that multiple exposure events were not considered credible because it was assumed to be unlikely that loose radioactive material on the ground would remain in place in any significant concentration over multiple days due to the wind and rain that are common to the area. A single ingestion event resulting in an internal radiation exposure is assumed in the SPRG calculation presented in the Memo. However, the assumption that there would be only a single exposure scenario does not meet the expectation for reasonable consideration for the recreational scenario for either a child or adult. Given that residential housing is planned nearby, it is likely that the nearby residents will visit the shoreline of the shipyard area for recreational purposes on multiple days within any given year. Also, it only rains for part of the year; during the dry season, rusty particles would accumulate. In addition, Appendix M indicates the elevated alpha activity detected at the shipyard areas, attributed primarily to Po-210, is widespread throughout the shipyard area where multiple exposures could occur in a single day. Multiple exposures should be considered credible and incorporated into the risk calculations. Please incorporate multiple exposures into the risk calculations.
5. **Exposure Events:** The risk from exposure to a radiation hazard cannot be compared to the potential risk from drowning. The Memo states that risk to the dose receptor, i.e., an unattended child near the water's edge, posed by drowning far exceeds and effectively negates the incrementally increased risk posed by the radiation hazard. However, the comparison of risk from ingestion of radioactive material to risk posed by drowning of an unattended child has no bearing on a statutory determination of whether a release of a hazardous substance, such as exposure to a one or more radionuclides may result in a risk greater than $10E-06$ – $10E-04$ excess lifetime cancer risk (ECLR). The statutory mandate regarding the assessment of risk due to the release of a hazardous constituent is promulgated by the National Contingency Plan (NCP) and Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) in 40 CFR 300.430(e). Please delete the comparison to risk associated with drowning from the Memo.
6. **Source Term:** The source term should be based on laboratory results, not the gross alpha surface scan. The source term is assumed to be composed of Po-210 equivalent to an average concentration of 200 disintegrations per minute (dpm) per 100 square centimeters (cm²) distributed on the ground in a 5 square meter (m²) area around the bollard or cleat. The average concentration of 200 disintegrations per minute (dpm) per 100 square centimeters is based on a gross alpha survey of the surface. However, a gross alpha measurement significantly underestimates the amount of radioactivity present due to the short distance and shielding involved in the metal structure itself, and represents the low-end of the measured range of the 200 to 400 dpm/100 cm². Therefore, only the destructive laboratory analysis should be relied on to estimate the amount of radionuclides present in the rust material. Appendix M reported the following detections of radionuclides: Beryllium-7 (Be-7) at 2.821 picoCuries per gram (pCi/g); Lead-210

(Pb-210) at 9.876 pCi/g; Pb-214 at 0.328 pCi/g; and Po-210 at 19.743 pCi/g. Please use laboratory data to estimate the amount of radionuclides present.

7. **Source Term:** A single exposure event is unrealistic. The Memo reports that based on their assumptions and radionuclide concentration inputs in the SPRG calculator, the Surface PRG for ingestion of Po-210 is 0.163 Becquerels per square centimeter (Bq/cm²), which converts to 978 disintegrations per minute (dpm)/100 cm² (using the conversion factor of 1 Bq/cm² = 6,000 dpm/100 cm²) at a target cancer risk of 1 x 10E-06. The Memo also states that the calculated ingestion SPRG for Po-210 (978 dpm/100 cm²) is significantly higher than the source term concentration assumed for this exposure scenario of 200 dpm/100 cm²) and using the 200 dpm/100 cm² value results in an equivalent cancer risk of 2.0 x 10E-07. However, the Surface PRG value and associated risk are based on an assumption of a single exposure event (i.e., 4 hours for 1 day per year) to an adult worker, with minor modifications made to the calculation to account for a child. These assumptions are very limiting and do not meet the expectations of a realistic scenario based on an agreed upon conceptual site model nor do such assumptions meet the intent of risk evaluation under CERCLA and the NCP. A more realistic scenario based on multiple exposures is needed. Please use a more realistic scenario that includes a child playing along the shoreline for 250 days per year for six years, which is the typical scenario used for child exposure in risk assessments.
8. **Source Term:** It is unclear why all detected radionuclides were not included in risk calculations. The Tech memo states that for modeling purposes, the source term also is assumed to include Po-210 progenitors bismuth (Bi)-210 and Pb-210, both of which are beta emitters, and all in secular equilibrium. This is consistent with the sampling results, which found near equal concentrations of both gross alpha and gross beta activity. However, the Tech Memo does not provide information about the concentrations assumed for Bi-210 and Pb-210 (i.e. the branching ratios used), therefore the information in the Memo is incomplete. Appendix M reports activity from the bollard composite sample collected in 2014 as follows: Beryllium-7 (Be-7), at 2.821 pCi/g, Potassium-40 (K-40) at 2.248 pCi/g, Cesium-137 (Cs-137) at 0.947 pCi/g, Lead-210 (Pb-210) at 9,876 pCi/g, Pb-214 at 0.328 pCi/g, Po-210 at 19.743 pCi/g, and Strontium-90 m(Sr-90) at 0.519 pCi/g, yet the Memo does not explain why some of these radionuclides were not included in the SPRG calculations. It is understood that environmental radionuclides such as K-40 do not need to be included in the calculation of risk, but it is not clear why radionuclides of concern (ROCs) for the ship berth areas (i.e., Cs-137 and Sr-90), as well as Pb-214 (progenitor to Po-210) were not included. To estimate risk, all ROCs should be included in the SPRG calculation. Please use all detected ROCs in the risk calculations and provide the concentrations assumed for Bi-210.
9. **Source Term:** The Memo does not consider that the elevated Minimum Detectable Concentration (MDC) reported for Ra-226 and Bismuth-214 (Bi-214) and the detection of Pb-214 and Pb-210 indicate that Ra-226 was likely present below the MDC. The Memo states the presence of Po-210 cannot be attributed to legacy Navy radiological operations because its progenitor Ra-226 (1,600 years) and Po-210 would have reached secular equilibrium many years ago and parent/progenitor radionuclides would be present

in comparable concentrations, which they are not. The text also states no other alpha-emitting radionuclides, including Ra-226, were detected in the analysis of the sample collected from the metal surfaces. However, Appendix M reports the detection of Pb-214, a decay product of Radium-226 (Ra-226) at 0.3 pCi/g, which indicates that Ra-226 was actually present. In addition, the MDCs reported for Ra-226 and the other main gamma and alpha-emitting daughter product, Bi-214 are elevated at 1.372 pCi/g and 2.089 pCi/g, respectively. The elevated MDCs and the detection of Pb-214 indicate Ra-226 was most likely present but not reported as detected due to the elevated MDCs for Bi-214. Further, if the sample was not sealed and allowed to equilibrate for 21 days, then a large percentage of the radon gas may have been lost, resulting in artificially lower reported concentrations or non-detect results for Bi-214, Pb-214, and Ra-226. Further, since the Po-210 is present in elevated concentrations on the metal structures due to the plating out of this radionuclide from the decay of radon, Po-210 is ultimately present due to the presence of Ra-226, and current information presented in the Memo regarding the source of Ra-226/radon-222 is not sufficient to determine whether the source of Ra-226 is environmental or contamination at the site or on the bollards. Finally, there is data that indicates that radon-222 is not present at high concentrations in the Bayview Hunters Point area. None of 7 tests in the 94124 zip code resulted in detection of radon above 4 pCi/liter (<http://www.city-data.com/radon-zones/California/California.html>). Please revise the Memo to acknowledge that the source of Po-210 is likely radium paint that was used on the bollard in the past. Also, please revise the Memo to acknowledge that due to the detection of Pb-210 and Pb-214 and the elevated MDCs for Ra-226 and Bi-214, Ra-226 was likely present in the sample. Finally, please revise the Memo to acknowledge that radon 222 is not present at high concentrations in the Bayview Hunters Point vicinity.

10. **Risk:** The risk to a child receptor is unacceptable if the bollards and metal surfaces are not remediated to mitigate potential exposure. The Memo reports on the results from the SPRG calculations used to identify an ingestion preliminary remediation goal for Po-210 based on an assumed concentration derived from a 200 dpm/cm² alpha survey of a metal bollard for a worker scenario, with some noted exceptions to the default parameters. It is noted that the SPRG calculation assumes the contaminated media is dust. An independent SPRG calculation was performed using the worker exposure scenario with the exception that some exposure parameters were modified where deemed appropriate to more closely simulate a child recreator scenario at the HPNS. These modifications include the following: an exposure duration of 6 years, 250 days, 4 hours per day; a hand to mouth transfer frequency of 10; a finger surface area of 16 cm²; contamination /exposure surface area of 100 m², and using the San Francisco climate zone. Concentrations obtained from Appendix M in pCi/g were converted to units of pCi/cm² by assuming a density for rusted metal of 5.12 g/cm³ and an assumed combined dust particle surface area of 1 square millimeter for ingestion to obtain concentrations in pCi/cm². The results of this calculation indicate that the ingestion PRG for the five radionuclides included in the analysis are as follows: Cs-137 – 0.655 pCi/cm²; Pb-210 – 0.00102 pCi/cm²; Pb-214 - 0.00102 pCi/cm², Po-210 – 0.00145 pCi/cm², and for Sr-90 – 0.355pCi/cm². The risk to the child recreator using these assumptions is equal to:

Radionuclide	Ingestion PRG (pCi/cm ²)	Ingestion Risk
Cs-137	7.4E-07	4.9E-08
Pb-210	4.95E-04	1.4E-04
Pb-214	1.64E-05	4.67E-06
Po-210	6.97E-04	1.32E-04
Sr-90	7.5E-07	1.04E-07
Total Risk		1.21E-03

Using the source term and site-specific exposure parameters listed above, the total risk from the intake of dust/metal particles contaminated with Cs-137, Pb-210, Pb-214, Po-210, and Sr-90 is estimated to be 1.21E-03. This calculated risk exceeds the risk range of 10E-04 – 10E-06. As such, based on this analysis, all metal structures and areas surrounding these structures will require some type of remediation to mitigate the unacceptable potential risk to the future recreator child or adult. Please revise the Memo to include this information and discuss a path forward for mitigating the risk posed by metal structures/surfaces at the ship yards.